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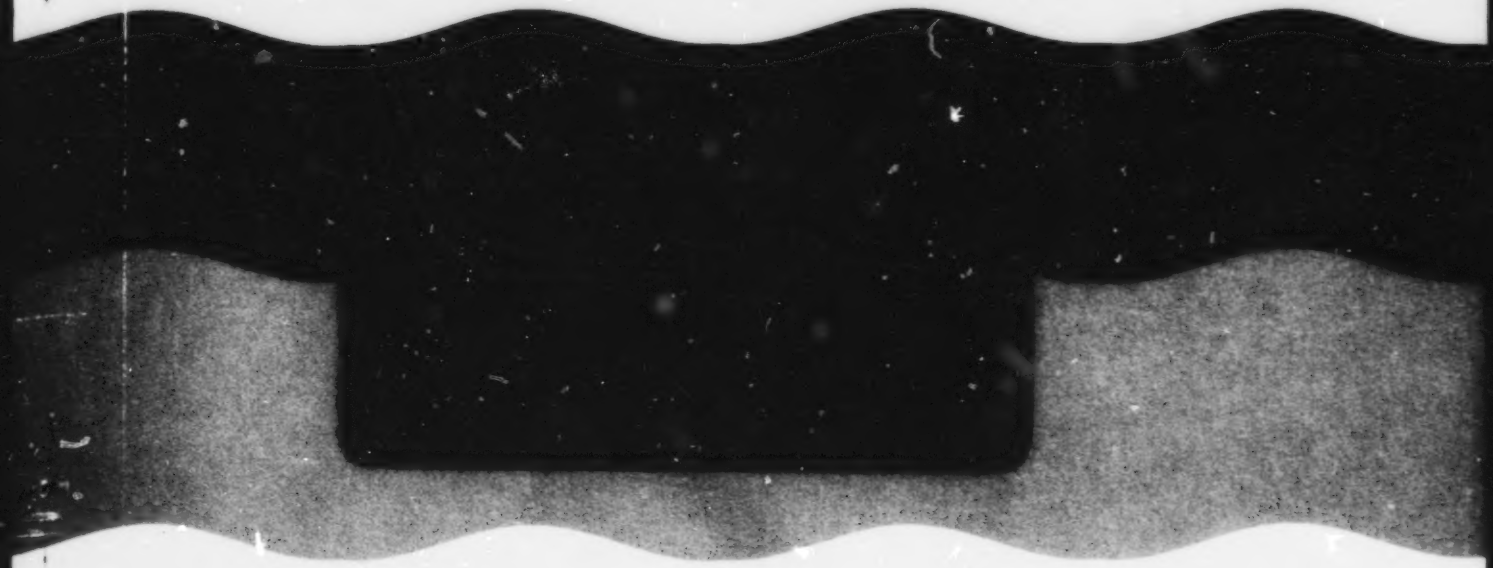

Investigation Report to the Minister pursuant to sections 477 or 480 of the Canada Shipping Act (1985)

Rapport d'investigation au Ministre conformément aux articles 477 ou 480 de la Loi sur la marine marchande du Canada (1985)

Canada

91-02313/

Ce rapport est aussi disponible en français.

REPORT OF INVESTIGATION INTO THE CIRCUMSTANCES ATTENDING THE SEVERE DAMAGE SUSTAINED BY THE M.V. "IMPERIAL ACADIA" WHILST ALONGSIDE THE DOCK AT MIQUELON, JANUARY 30/31, 1990.

REPORT No. 548.

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REPORT OF INVESTIGATION INTO THE CIRCUMSTANCES ATTENDING THE SEVERE DAMAGE SUSTAINED BY THE M.V. "IMPERIAL ACADIA", WHILST ALONGSIDE THE DOCK AT MIQUELON, JANUARY 30/31, 1990.

Particulars of Vessel

Name	"IMPERIAL ACADIA"
Official Number	326037
Port of Registry	Halifax, N.S.
Gross Tonnage	7,068
Net Tonnage	3,908
Length	134.1 m (440 ft)
Breadth	18.3 m (60 ft)
Depth	9.4 m (31 ft)
Draught	F: 5.33 m (17.5 ft) A: 6.70 m (22 ft)
Type	Coastal tanker
Hull	Steel, all welded
Built	1966 Port Weller, Ontario
Propulsion	B&W, 4,900 HP, one fixed-pitch propeller, bow thruster 375 HP
Cargo	Vessel in ballast at time of casualty
Crew	15, including master
Owner	Imperial Pipeline Co. Ltd. Calgary, Alberta
Operator	Esso Petroleum Canada

Navigational Equipment

Radar 1	JRC JMA 825-9
Radar 2	JRC JMA 626-7
Loran C 1	Mieco C-Master
Satellite Navigator	JRC JLE-3850

Gyro Compass	Anschultz-Kiel and Sperry MK-37
Magnetic Compass	Yes
Course Recorder	Anschultz
Echo Sounder 1	Simrad EN
Echo Sounder 2	Simrad Type 511-4N
Auto Pilot	Anschultz
Weather Fax Recorder	Yes

Radio Equipment

VHF 1	Clipper VII
VHF 2	Uniden
SSB 1	Inmarsat CH150
SSB 2	Inmarsat CH150

Particulars of Vessel

This vessel was built and has operated, as a petroleum tanker, in both the Great Lakes and East Coast of Canada trades. Of a single skin construction, she has neither wing tanks (other than cargo tanks) nor double bottom tanks, except under the engine-room. The total cargo carrying capacity is 12,867 tons in six wing tanks on each side of the vessel, seven centre tanks and two 'specialty' tanks.

The vessel has a raised forecastle and poop deck, with a flush main deck. The main engine, crew accommodation and navigating bridge are aft. The main engine may be manoeuvred from either the navigating bridge or the engine-room. The bow thruster is also operated from the wheel-house. (See Annex I.)

The vessel's certificates were found to be in order.

NOTE: (1) All times mentioned in this report are expressed in Atlantic Standard Time (UTC minus 4 hours).

(2) All references to the Canada Shipping Act in this report refer to Chapter S-9-1985 of the Revised Statutes of Canada.

Background

The "IMPERIAL ACADIA" was required to discharge a small amount of diesel oil and gasoline at Miquelon.

She was berthed there at 0620, January 30, 1990, in the knowledge that regional weather forecasts were predicting easterly gales, becoming storm force winds later that day.

Cargo work took longer than had been expected so that by 1550, when the vessel was ready to sail, the weather had deteriorated to the extent that the vessel was unable to clear the port.

During the latter part of January 30 and until 0640, January 31, easterly storm force winds caused heavy seas to build up in Anse de Miquelon. These forces combined to cause the vessel to pound heavily and surge bodily against the dock.

Mooring ropes broke, the starboard side of the vessel was severely damaged and the dock was partly demolished. (See copy of Miquelon Dock Plan, Annex II.)

Narrative

The "IMPERIAL ACADIA" had discharged the main part of her cargo at Lewisporte, Newfoundland, and, in a 'winter ballasted' condition, (see Analysis 1a) sailed from that port on January 28, 1990.

At that time, she had on board a small amount of gasoline (43 m^3) and diesel oil (374 m^3) for discharge at Miquelon. Her departure draught, Lewisporte, was forward 5.49 m (18 ft), aft 6.70 m (22 ft), which was not expected to change appreciably during the 2 day voyage to Miquelon. (See ballast/cargo disposition Annex III.)

During the night of January 29/30, the vessel's speed was adjusted to 'slow', as a NW'ly gale was blowing, and the master had decided not to berth at Miquelon in such conditions, but to wait in the sheltered waters on the east side of Grande Miquelon and Petite Miquelon for the wind and sea to abate.

At 0400, January 30, the wind force was recorded at Beaufort scale 4 (11-16 knots) from a NW'ly direction and the master determined that under these conditions it was safe to dock at Miquelon.

During the voyage between Lewisporte and Miquelon, it had been calculated that 5-6 hours would be required to connect and disconnect the cargo hoses (the shore side receiving manifold on

the southern area of the dock necessitated approximately 152 m of cargo hose per product), discharge the cargo and deal with the associated tank soundings and paper work.

The vessel was 'all fast' at Miquelon at 0620, January 30, after which deployment of lengths of cargo hose from the vessel commenced.

Prior to arrival at Miquelon, the master and the three mates had heard radio broadcasts of weather warnings from various Canadian Coast Guard Radio Stations(CGRS). These had included the forecast of "winds increasing to easterly winds 30 (knots) to gales 40 (knots) Tuesday (January 30) afternoon" for the area Newfoundland, Southwest Coast. The islands of St. Pierre and Miquelon are within this forecast area.

At 0424, January 30, the weather forecast was updated Southwest Coast - "Storm warning issued. Storm force easterly winds to 50 knots will develop over the above waters this afternoon."

At 0935, a further forecast, "increasing to easterly 30 near noon and to easterly gales 45 to 55 this afternoon".

It was against the backdrop of these weather forecasts and a deepening low pressure area on the weather fax printout, that the decision to berth at Miquelon was made.

A defect in a section of cargo hose delayed the discharge of the cargo, and a fault in the mechanism of the hose storage reel delayed the recovery of the hose.

The result of these delays was that the vessel was still alongside at 1550 when the first attempt was made to sail; i.e., 3½ hours after the initial time frame had expired.

Between 1550 and 1624, various attempts were made to get underway, but these were unsuccessful because of the wind and sea. (See Annex V for diagrams.)

After 1624, the vessel was resecured alongside the eastern side of the dock, fully exposed to the wind and the onslaught of the fetch of the seas.

During the night of January 30/31, easterly winds of 56-63 knots (Beaufort force 11) were recorded on board the vessel, mooring lines parted, dockside fendering was destroyed, reinforced concrete coping on the dock face was severely damaged, whilst the interlocking steel face of the dock was set in, distorted and fractured.

The vessel, driven repeatedly and heavily onto the dock face throughout the night, was badly damaged along her starboard side over an approximate length of 97 m (318 ft). Vertical cracks in the shell plating developed over a length of 8.8 m (29 ft) extending from under the main deck to the turn of the bilge. The starboard side was set in in several places to a depth of 1.2 m (4 ft).

Damages to internals in way of these areas were also found to be extensive. (See Annex I).

From approximately 1800, January 30, until 0640, January 31, the master attempted, with various engine movements, to alleviate the heavy pounding of the vessel against the dock. At approximately 2042, the starboard diesel oil day tank in the engine-room was punctured. This is a 'high' tank bounded by the shell plating and separated from the engine-room by an athwartship bulkhead. When that bulkhead fractured, approximately 3-4 barrels of diesel oil ran into the engine-room.

The chief engineer mobilized his staff to mop up the oil, whilst fire hoses and fire extinguishers were readied and the remaining contents of the damaged tank were transferred to another tank.

Until approximately 2300, crew members had been jumping between the vessel and the dock to replace broken mooring lines. By then this was deemed to be too dangerous as the concrete coping and mooring posts were being destroyed.

The only tug in the area, a French navy vessel, "TNACHE", was unable to assist as she was hove-to in the same severe storm.

After all mooring lines had parted, the master maintained a relative position to the dock with various main engine movements and the bow thruster.

At approximately 0230, January 31, it was noted that the vessel had developed a starboard list and that the starboard wing tanks, numbers 2, 3, 4 and 5, were damaged. Of these tanks, numbers 2 and 4, which had been empty, were suffering an ingress of water, numbers 3 and 5, which contained ballast, were leaking outwards to the sea. (See Annex III for ballast diagram.)

Equalizing valves to tank numbers 2 and 4 port were opened in an unsuccessful attempt to correct the list. At sometime between 0230 and 0315 the vessel struck the bottom.

Deballasting from various tanks was commenced to lighten the vessel. This was accomplished by approximately 0525, when discharge of 'dirty' ballast was stopped.

Pollution, if any, was dispersed by the action of wind and waves.

Eventually the wind eased and the vessel departed the dock at Miquelon at 0640; she sailed round the islands, seeking a quiet water anchorage in order that the starboard side damage could be more accurately assessed, after which, she proceeded to Marystown, Newfoundland, escorted by the tug "TNACHE". She arrived there at 0845, February 1.

Whilst there, the decision was made to have permanent repairs carried out at Halifax.

The vessel was considered to be in such a distressed condition that extensive temporary repairs within the limited capabilities of the facilities at Marystown would not guarantee a safe trip, through ecologically sensitive fishing areas, to Halifax.

She was 'piggy-backed' on the semi-submersible Dutch registered vessel "MIGHTY SERVANT 1" to Halifax Harbour on March 17.

Permanent repairs were completed on May 24, 1990.

Analysis

1. Events prior to arrival Miquelon

a. Draught consideration

Approaching Lewisporte, and in the vicinity of Burnt Bay, heavy ice had been encountered. Apparently the land fast ice in Burnt Bay had slowed the vessel's progress. This condition had been recorded once in the deck log book at 2200, January 26. In anticipation of similar ice conditions on the return trip, the master had ordered the vessel 'winter ballasted'. This condition was satisfied with a departure draught of forward, 5.49 m (18 ft) aft 6.70 m (22 ft) and in the knowledge that, allowing for fuel, water, stores consumed en route, the after draught arriving Miquelon should be approximately 6.65 m (21'10") with a negligible change to the forward draft.

That draught was deemed necessary by the master to ensure the propeller and rudder were well immersed in the water for safety in manoeuvreing in ice infested waters. The presence of ice was not recorded in the deck log book on the return journey, although it was encountered.

The owner's 'port' manual recommends that a vessel's draught should not exceed 5.79 m (19 ft) for docking at Miquelon. The manual also states that the maximum length of a vessel using the dock (at Miquelon) should not exceed 114.3 m (375 ft). The length of "IMPERIAL ACADIA" is 134.1 m (440 ft).

The master, having been to Miquelon on this and other vessels (whose lengths also exceeded 114.3 m), was confident that the length restriction no longer applied.

He also knew from experience and tide tables that the least depth of water to be found at the northern end of the dock on the eastern side was approximately 7.37 m (24.17 ft).

b. Weather consideration

The islands of Saint Pierre and Miquelon are within the weather forecast area of Newfoundland 'South West Coast'.

Canadian Coast Guard Radio Stations at St. John's, St. Lawrence, Stephenville, Newfoundland, and Halifax and Sydney, Nova Scotia, broadcast weather forecasts for Atlantic Coast, Gulf and River St. Lawrence. A complete list of radio stations, their broadcast frequencies and times are contained in Part II of Radio Aids to Navigation. These stations may also provide a weather forecast upon request.

The vessel was equipped with the publications, radios and all the necessary information to receive the weather forecasts for Newfoundland, coastal areas, issued periodically by Environment Canada.

The master and mates were aware of the importance of these forecasts, and indeed the vessel's arrival at Miquelon had been initially delayed, during the night of January 29/30 until the forecast strong NW'ly winds had diminished.

In the knowledge that easterly gale and storm force winds for the area were forecast for later in the day, January 30, the vessel was berthed at Miquelon at 0620.

c. Cargo consideration

Prior to arrival at Miquelon, the master had

discussed with the first mate the length of time which would be required to discharge the cargo for Miquelon. It was estimated that 5-6 hours would be required for handling the hose, discharging the cargo, sounding tanks and associated paper work. It was known before arrival that the distance between the vessel's manifold and the shore side connection would necessitate the special use of approximately 305 m (1,000 ft) of hose in two equal lengths, one for the gasoline and the other for the diesel oil.

This cargo 'floater' hose is stowed on a mechanically operated reel, on the starboard side of the boat deck.

2. Delays at Miquelon

Whilst the cargo hose was being readied, a weak spot and possible hole in one of the lengths was found, which necessitated remedial work being performed and which delayed the commencement of discharge until 0930. By then, the master, on the bridge, was monitoring the weather facsimile displays and radio broadcasts, aware that approximately half the estimated 'time alongside' had been used up.

At 1400 the discharge of the cargo had been completed and recovery of the hose commenced, however, a defect in the pneumatic mechanism prevented the hose reel being used in a 'power on' mode and was being hand operated.

Approximately 30 minutes later the master ordered the cargo hose to be brought on board without stowing it on its reel. This work was completed at 1550; i.e., 9½ hours after the vessel's arrival.

3. Weather Observations

"IMPERIAL ACADIA" is a voluntary weather reporting station (one of many such ship-stations) which provides Environment Canada with actual weather several times per day when the vessel is at sea. The last such message had been sent via St. Lawrence CGRS at 1342/1400 January 29.

To assist in this work, an anemometer, aneroid barometer and barograph had been provided to the vessel by the Atmospheric Environment Service, Atlantic Region.

The anemometer was graduated in knots and was accurate to ±4% or 1 knot, within a temperature range of -50°C to +50°C and would indicate wind speeds of up to 150 knots.

The unit of measurement was not indicated on the instrument. That information is generally known to mariners and has been so for many years.

The master was of the opinion that this instrument was calibrated in miles per hour, whilst the watchkeeping mates recorded the wind speed in knots directly from the instrument, in the deck log book, in their reports, and weather log books.

The barometer was correctly calibrated, reading in millibars, and in the four weather reports sent by the vessel whilst on passage between Lewisporte and Miquelon the barometric pressure, as reported, was compatible with other known pressures.

The staff of Environment Canada does not consider the marine barograph, as supplied to "IMPERIAL ACADIA", to be sufficiently accurate to be a pressure indicating sensor, as these instruments are designed and built to provide a record of pressure tendency, that is, a record of how much the pressure has changed over a period of time.

The downward trend illustrated by the barograph confirmed graphically the forecast approaching low pressure system.

There was no comparison made by the officers of "IMPERIAL ACADIA" between the barometer and the barograph readings, some of which are compatible whilst others are not. (See Annex IV.)

By noon, January 30, the downward trend of barometric pressure was indicated by the barograph, but not recorded as such in the deck log book. These log book entries were as a result of reading only the barometer. The nearest weather recording/reporting station at St. Pierre did not record wind velocities in the area between the hours of 1800Z January 30 and 1800Z January 31st. Other weather forecasts were compatible with the weather experienced and recorded by the vessel.

4. Charts and publications

The largest scale Canadian Chart No. L/C 4626 of the Islands of St. Pierre and Miquelon was on board the vessel and corrected up to date. That chart does not indicate the dock at Miquelon in detail; neither are water depths clearly shown at the dock due to its relatively small scale. The chart also shows two mooring buoys off the dock which have not been there for at least 10 years.

The Canadian publication, Sailing Directions, Newfoundland, includes information pertaining to Miquelon which has not been updated, the details of which do not effect the casualty but may cause confusion to the uninitiated; i.e., "There is a mooring for vessels, and another for seaplanes near the settlement" (of Miquelon). No such moorings exist. "There is a concrete wharf alongside which vessels drawing less than 11 feet (3.4 m) can lie, situated adjacent to the settlement."

The warning contained in this publication is apt, "With strong NE and E winds vessels lying in this anchorage (Anse de Miquelon) should be ready to weigh anchor instantly."

The vessel also had on board a copy of a French Chart, St. Pierre et Miquelon, which includes a large scale insert of the dock at Miquelon and on which water depths in metres are indicated in greater detail than on the Canadian chart of the same area. (See chartlets.)

5. Tidal information

The best information on board the vessel, in relation to the times of high and low water at Miquelon, can only be based on the tidal information in respect of St. Pierre (i.e., the secondary port based on Argentia, Newfoundland).

The distance and tidal directions between St. Pierre and Miquelon will affect the times of high and low water at the latter port, but in the afternoon of January 30 the easterly wind probably affected the tidal flow by an incalculable amount. The easterly wind would tend to increase water depths in Anse de Miquelon, particularly in the western area of the bay, where water levels would tend to 'build up'. The times of tides at Miquelon on January 30 and 31 were calculated as follows:

	H.W.	Height above chart datum	L.W.	Height above chart datum
Jan. 30	1042	2.1m(7.0 ft)	0407	0.5m(1.8 ft)
	2257	2.0m(6.6 ft)	1627	0.5m(1.8 ft)
Jan. 31	1127	2.0m(6.6 ft)	0447	0.6m(1.9 ft)

From this information and previous experience, the master was confident that there would be at least a 0.6 m (2 ft) under-keel clearance, aft, when the vessel was alongside at Miquelon, upon docking in relatively fine

weather.

The change in the vessel's draught, due to the discharge of cargo at Miquelon, was mainly forward and the departure draught (January 30) was forward 5.33 m (17'6"), aft 6.70 m (22').

6. Attempts to clear the dock

When the vessel was berthed at Miquelon, no bower anchor had been deployed.

In the absence of such an aid, the master attempted, firstly, to clear the dock using only the bow thruster. By this time, 1550, the wind had increased to easterly recorded in the deck log at 1600 as force 7-8 (28-40 knots). The master reported the wind to be 25-35 m.p.h. with gusts to 40 m.p.h. (40 knots = 46 m.p.h., approximately).

The bow thruster, thrusting to port, acting in opposition to the wind on the port side of the vessel, was unable to move the forward part of the vessel off the dock.

Another attempt to get the vessel's bow off the wharf was unsuccessful and abandoned after about 2 minutes. The stern of the vessel did not overhang the north end of the dock sufficiently for the wind to act favourably upon it, and no mooring line had been used from the starboard quarter to the north end of the dock to assist in that manoeuvre.

The next attempt to sail included running two wires (mooring lines) ashore from forward, as 'back springs', to hold the vessel from moving forward and to pivot at the curve of the bow 'shoulder'. This manoeuvre was carried out by placing the helm hard-to-starboard and the main engine turning ahead.

However, between approximately 1557 and 1603, with the engine slow ahead and at half speed for approximately 1½ minutes in two periods, one of the mooring wires parted, whereupon that attempt was concluded.

At approximately 1616, a third attempt was made to clear the dock. This required that two head lines were led from the bow to bollards on the southern 'arm' of the dock. When these lines were tight, the main engine was run astern.

The combined effect of the water forced between the dock and the vessel acted as a wedge and the transverse thrust of the propeller moved the stern of the vessel some 9 m (30 ft) off the wharf. The manoeuvre lasted for about 2 minutes after which one headline parted and the other line was let go. The vessel went astern for some distance, but the master, fearful of the vessel going aground north of the dock, manoeuvred her back alongside.

At approximately 1624, the vessel was being resecured, when the master, on the bridge/engine-room telegraph, indicated 'finished with engines'.

7. Weather deterioration

Between 1630 and 1800, the weather continued to deteriorate, the easterly wind increased to 34-47 knots (the master recorded 35-45 m.p.h.), with the vessel pounding heavily on the dockside fenders.

By 1800, the master, using the main engine (which on the chief engineer's orders had been kept in a state of readiness) and the bow thruster, attempted to alleviate the vessel's pounding.

At approximately 1900, the fenders had been mainly destroyed and the concrete coping along the face of the dock was being attacked. Seamen were jumping between the vessel and the dock, as she surged alongside, to replace broken moorings.

As the dockside mooring posts and masonry crumbled and fell, the replacement of broken mooring lines became impossible for the crew.

During the hours of darkness, the wind, as forecast, increased to storm force 56-63 knots. The master recorded winds of up to 60 m.p.h. (60 knots = approximately 69 m.p.h.) with snow driving horizontally across the vessel, reducing visibility. The air temperature of -4°C, effectively -27°C or lower with the wind chill factor applied, provided harsh conditions for the mates and seamen working on deck.

Sea water and spray was thrown upwards to heights estimated to be 10 m (33 ft) between the side of the vessel and the dock as the vessel surged bodily alongside.

Seas, unrestricted by any landmass, increased with the

wind, caused the vessel to rise and fall whilst being slammed bodily against the dock.

8. **Vessel damage**

The deck log book provides no record of vessel damage until 0230, January 31, when it was noted that she had a starboard list and starboard side tanks numbers 2, 3, 4 and 5 had sustained damage.

On January 30, at 2330, the entry reads, "The sea state worsening by the hour, tending lines all watch as they keep busting. V/L taking a beating alongside the dock. All dock fenders broken. The dock badly damaged." and at 2400, "Unable to get away from dock, very heavy sea on the dock."

As a result of the successive impacts with the dock face, the vessel suffered severe damage along the starboard side, over a length of approximately 97 m (318 ft) from number 1 starboard wing tank to and including the engine-room, extending downwards from the main deck 8.8 m (29 ft) and upward in the accommodation area approximately 4.9 m (16 ft). The damage extended inboard up to 1.7 m in places, where the shell plating has been fractured, heavily set in and distorted. Internals in the way of these areas were fractured, heavily set in and distorted, and increased in severity from forward to aft.

9. **Risk of explosion/fire**

As stated elsewhere in this report, the starboard side tanks had, prior to and on arrival at Miquelon, contained gasoline. Of these six tanks, three had been ballasted and three were empty.

In this type of vessel, after gasoline has been discharged, a relatively small amount of product usually remains in the tank as being unpumpable. This is due to small amounts of gasoline trapped in corners and adhering to surfaces, perhaps amounting to 2-3 barrels. In that condition, the atmosphere in the tank is extremely rich with gasoline vapour. When that condition is diluted with air, an 'explosive' mixture can be achieved.

The tanks containing ballast were not full, so that the space between the top of the water ballast and the underside of the tank can also contain a mixture of gasoline vapour and air. The vessel can, therefore, be

considered to have been in an explosive condition.

As the shell plating forming the side of the wing tanks ruptured, water from the ballasted tanks flowed out, and air in, and in the hitherto 'empty' tanks, water and air were allowed entry.

By this time, about 1900, the fendering had been destroyed and the vessel was bumping and grinding on the reinforced concrete and steel face of the dock.

At approximately 2042, January 30, the upper starboard diesel (day) tank was ruptured when the shell plating and bulkhead forming part of its boundary was fractured by impact with the dock. At that time, the tank contained approximately 20 m^3 of diesel oil, of which an amount flowed into the engine-room.

The chief engineer notified the master of the damage and its results and organized his staff to reduce the oil level in the damaged tank, clean up the deck plates, rig fire hoses and repair a fractured CO_2 line (part of the installation for the engine-room's fixed carbon dioxide fire extinguishing equipment).

10. Risk of Pollution

Subsequent to the ingress of sea-water to the starboard side tanks, the vessel's draught increased and she developed a starboard list. It was recorded in the deck log book that at 0230, January 30, the "vessel was touching bottom". The engine-room staff recorded a 'bump' (bottoming) at 0315½, January 31. It was not possible to determine where and for how long the vessel remained on the bottom. (Apparently the sea bed near the face of the dock is without rocks and is mainly sand and/or small pebbles, similar to the beaches.)

There was on board the vessel, upon her arrival at Miquelon, approximately 257 m^3 of 'heavy' fuel oil (IF 180) and approximately 32 m^3 of diesel oil in various double bottom and other tanks, all aft.

There was no reported leak to the sea from the double bottom fuel oil tanks under the engine-room, or from the ruptured starboard diesel oil tank. A subsequent underwater survey confirmed the double bottom fuel tanks to be sound.

To correct the starboard list and lighten the vessel, equalizing valves to port side cargo tanks were opened

and ballast water was pumped out elsewhere. Between the hours of 0230 and 0525, January 31, ballast was handled in various ways.

On the starboard side of the vessel, water was entering tank numbers 2 and 4; water was flowing out of tank numbers 3 and 5. On the port side, tank numbers 2 and 4, filling line valves were opened to allow these tanks to flood by gravity from the sea.

Dirty ballast in centre tanks 2, 4 and 6 (which had contained diesel oil) were partially pumped out.

At approximately 0415, the vessel was deemed to be afloat. Deballasting continued until 0525.

The cargo tanks were not sounded and there is apparently no record of the ballast disposition from the time the vessel left Miquelon until her arrival at Marystown on February 1. Her arrival draught then was forward 4.24 m (14 ft), aft 5.75 m (19 ft).

11. **Attempts to stay alongside and/or depart**

Throughout most of the night of January 30/31, the master maintained a lonely vigil in the wheel-house, only interrupted by his officers periodically bringing him news of damages, either to the vessel or the dock or both.

Although 'finished with engines' had been rung, the main engine and auxiliary machinery had been maintained in a state of readiness, so that at 1800 when the master required to manoeuvre there was no delay.

The main engine, bow thruster and helm were used throughout the night in an endeavour to minimize the successive pounding, when the vessel landed heavily on the quay. Tug assistance was requested from the French navy vessel "TNACHE", but she was 'hove to' in the same storm some distance away and unable to render any help.

The master of "IMPERIAL ACADIA" requested, via the owners' agent at St. Pierre, additional fenders (even bales of hay) and shoreside labour to handle the mooring lines.

There were no other fenders at Miquelon and the efforts of the line handlers on the dock were continually thwarted as mooring lines parted very soon after being positioned.

At 0640, January 31, the wind backed to the northeast and diminished in force, allowing the vessel to sail.

12. **The dock at Miquelon**

The section of dock to which "IMPERIAL ACADIA" was secured lies in approximately a NNW/SSE'ly direction. This section of dock was completed approximately 12 years ago, and had comprehensive resurfacing work completed in October last year.

The face of the dock comprises 12 mm thick interlocking steel piling, driven into the sea bed to an approximate depth of 5 m.

The eastern side of the dock is finished with a reinforced concrete coping, on which were suspended nine fenders. Mooring posts were incorporated into the concrete coping at the top.

Smaller mooring posts were placed along the 'inside' (west) of the dock for Ro-Ro and passenger vessels, mainly from St. Pierre.

The fenders, of which there were nine, each approximately 7 m long, had a timber core, around which were 8 truck tires of approximately 1.5 m in diameter.

These fenders were suspended over the eastern face of the concrete coping by chains at their ends, secured to eyebolts set into the inside of the coping.

These tires and timbers were so destroyed that there was nothing left of them, the debris having been washed away, apparently, by the action of the sea.

That type of fendering is normally adequate for vessels the size of "IMPERIAL ACADIA" in berthing, lying alongside and sailing. The forces at work on the night of January 30/31 far outweighed the use to which these fenders had been designed.

The dock was severely damaged, to the extent that local authorities deemed it necessary to effect temporary repairs costing an estimated $400,000.00 to stabilize the structure.

It was feared that further demolition of the dock and possible loss of its protection, in the event of another easterly gale, could disrupt supplies to Miquelon and

adversely affect the townspeople. (See Annex II for details of dock damage.)

Permanent repairs and their costs have, reportedly, not yet been agreed or the necessary work put in hand.

13. Initial assessment of vessel damage

After leaving Miquelon, the master, in an endeavour to find sheltered water in which to assess the damage to the vessel, sailed anti-clockwise round the islands of Grande Miquelon and Petite Miquelon (see chartlet number 3), after which the vessel was anchored north of Cap Aux Morts at 1225. Up until then, the seriousness and extent of the damage to the vessel was not fully appreciated.

After the master had viewed the starboard side of the vessel, and reported to the vessel owners, it was decided to abandon the voyage and, escorted by the "TNACHE", to proceed at slow speed to Marystown, Newfoundland.

The vessel reached that port safely and was secured, 'boomed in', pending further survey on February 1st.

Whilst at Marystown, cargo tanks were cleaned and gas freed, after which further surveys, both above and underwater, were carried out.

It was latterly decided that permanent repairs would be undertaken at Halifax, and the "IMPERIAL ACADIA" would be 'piggy-backed' there by the semi-submersible vessel "MIGHTY SERVANT 1".

This course of action was deemed to be safe, economically viable and ecologically sound. Both vessels arrived in Halifax Harbour on March 17 after which the "IMPERIAL ACADIA" was refloated and prepared for dry-docking.

Repairs were later completed at a reported cost of approximately $4,000,000.00.

14. Frequency of visits to Miquelon

Since 1984 Esso Petroleum vessels, either owned or chartered, have averaged six voyages per year to Miquelon, apparently without mishap. Another petroleum transportation company also discharges diesel oil and gasoline at Miquelon but their vessels tend to berth at

the southern leg of the dock, bow in towards the beach.

15. Log Book Entries

Ice was encountered after sailing from Lewisporte but not recorded in the deck log book.

The reason for anchoring off Petite Miquelon on January 31 was not recorded in the deck log book.

16. Experience of master/officers

Master

The master possesses a Canadian issued (in 1975) Masters Certificate of Competency, Foreign Going, and a Halifax Harbour Pilots Certificate, issued in 1985, has sailed as master on this and other of the company's vessels since 1982. During this time he had carried out a significant number of dockings and undockings in Eastern Canadian ports.

This was his third trip into Miquelon as master, two other voyages having been undertaken on another vessel, 4 and 6 years ago respectively, and numerous times as first mate.

He has served with Messrs. Esso Petroleum in a variety of capacities since he joined the Company in 1976.

First Mate

Possesses a Canadian Certificate of Competency as First Mate, Home Trade (O.N.2), issued in 1987. He has served on this vessel in a relieving capacity during the last 7 years and in that role has been into Miquelon some six or seven times. Thus, he was aware of the inherent problems of easterly gales at that dock.

He has served with the company for approximately 10 years in a variety of capacities.

He was not a watchkeeper on the "IMPERIAL ACADIA". His main responsibility was cargo work, where apart from 'day work', his hours of duty were governed by the dictates of the loading and discharging programmes.

Second Mates

The two second mates maintained a system of 6 hours of duty and 6 hours off watch, alternately.

They possess Watchkeeping Certificates of Competency, issued in Canada in 1980 and 1986 respectively.

Prior to obtaining their certificates, they had both been employed by the company for many years in various capacities as seamen. Both had been into Miquelon several times on this and other vessels and were aware of the cargo handling facilities and its exposed dock.

Chief Engineer

Has sailed as chief engineer on this and others of the company's vessels since 1976. Prior to that he sailed in a variety of junior capacities during the 30 years he has been employed by Esso Petroleum. He possesses a First Class Certificate of Competency (Motor) issued in Canada in 1986.

Findings

During a night of easterly gales and storm force winds on January 30/31, 1990, the heavy seas thus generated, forced the "IMPERIAL ACADIA" to be repeatedly and heavily pounded against the Miquelon dock. It would appear that the following factors contributed towards this casualty:

- there was a delay in discharging the cargo and retrieving the hoses;

- the vessel was kept alongside despite the forecast storm, which was confirmed by onboard meteorological instruments;

- no anchor had been laid to assist unberthing, in the event that such a manoeuvre would be necessary;

- undue reliance was placed on the effectiveness of the bow thruster, and

- some 34 minutes of modest manoeuvring were unsuccessful in the endeavour to leave the dock and no further attempts at manoeuvring the vessel were undertaken.

Other Findings

The owners did not adhere to their own recommendations regarding length of vessel for berthing at Miquelon.

The Environment Canada anemometer supplied to the vessel does not state the units, which the Master believed to

be m.p.h., and was in fact knots, and the wind speed was therefore underestimated.

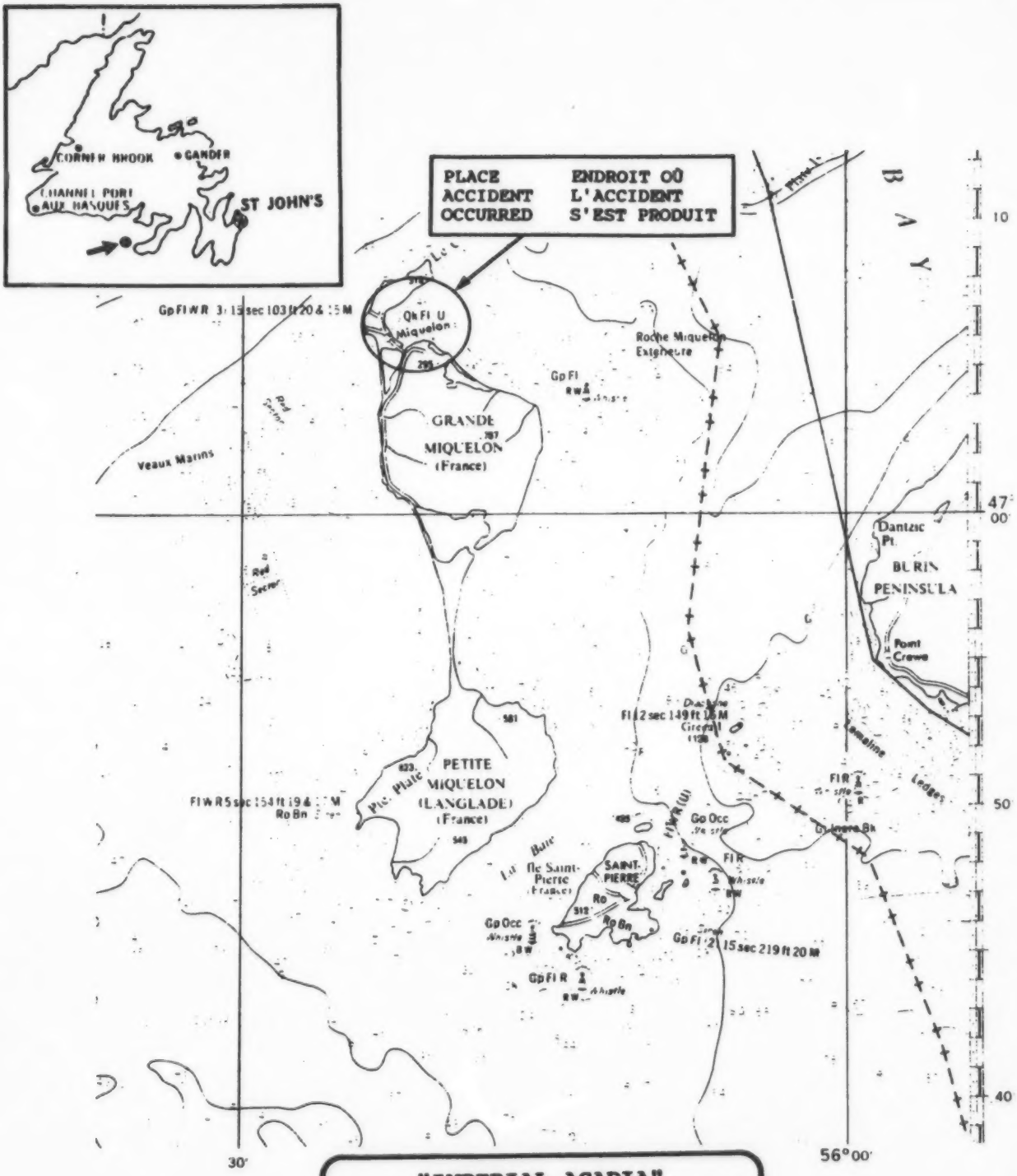
The wind, waves, spray and driving snow would have served to reduce the danger of explosion caused by the rupture of the cargo tanks.

To avoid further damage to the vessel, she was taken out of Miquelon in a severely damaged condition before a full inspection was undertaken.

The Canadian Hydrographic Service had not issued any Notices to Mariners concerning their chart No. 4626 and their publication Sailing Direction - Newfoundland to reflect the latest French hydrographic information with respect to Miquelon Harbour.

The crew, under adverse conditions performed well and, unable to use the gangway, engaged in a dangerous practice of jumping between the vessel and the dock to replace broken mooring lines.

OTTAWA, ONTARIO
NOVEMBER, 1990

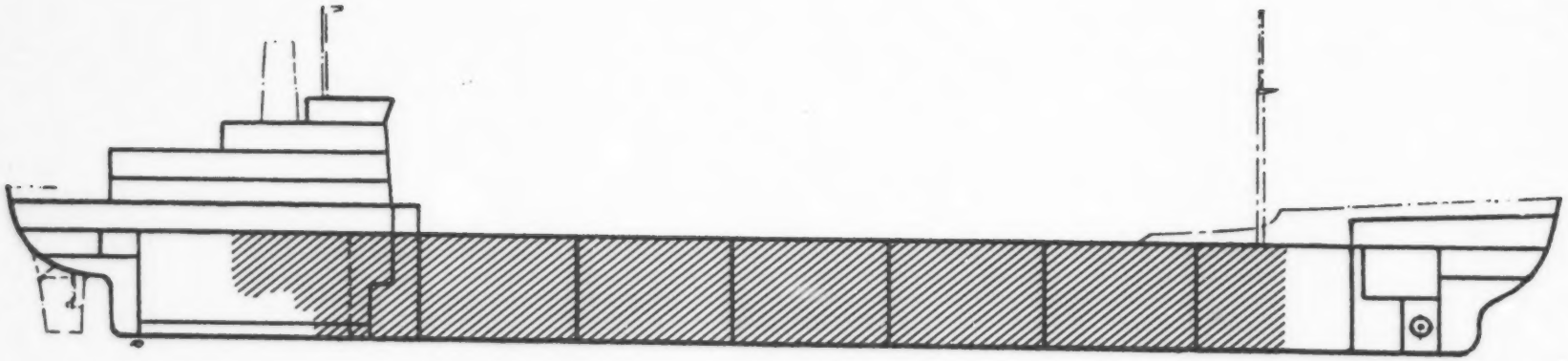


"IMPERIAL ACADIA"

SECTION OF CHS CHART No. 415

SECTION DE LA CARTE N° 415 DU SHC

NOT TO BE USED FOR NAVIGATION
NE PAS UTILISER POUR LA NAVIGATION

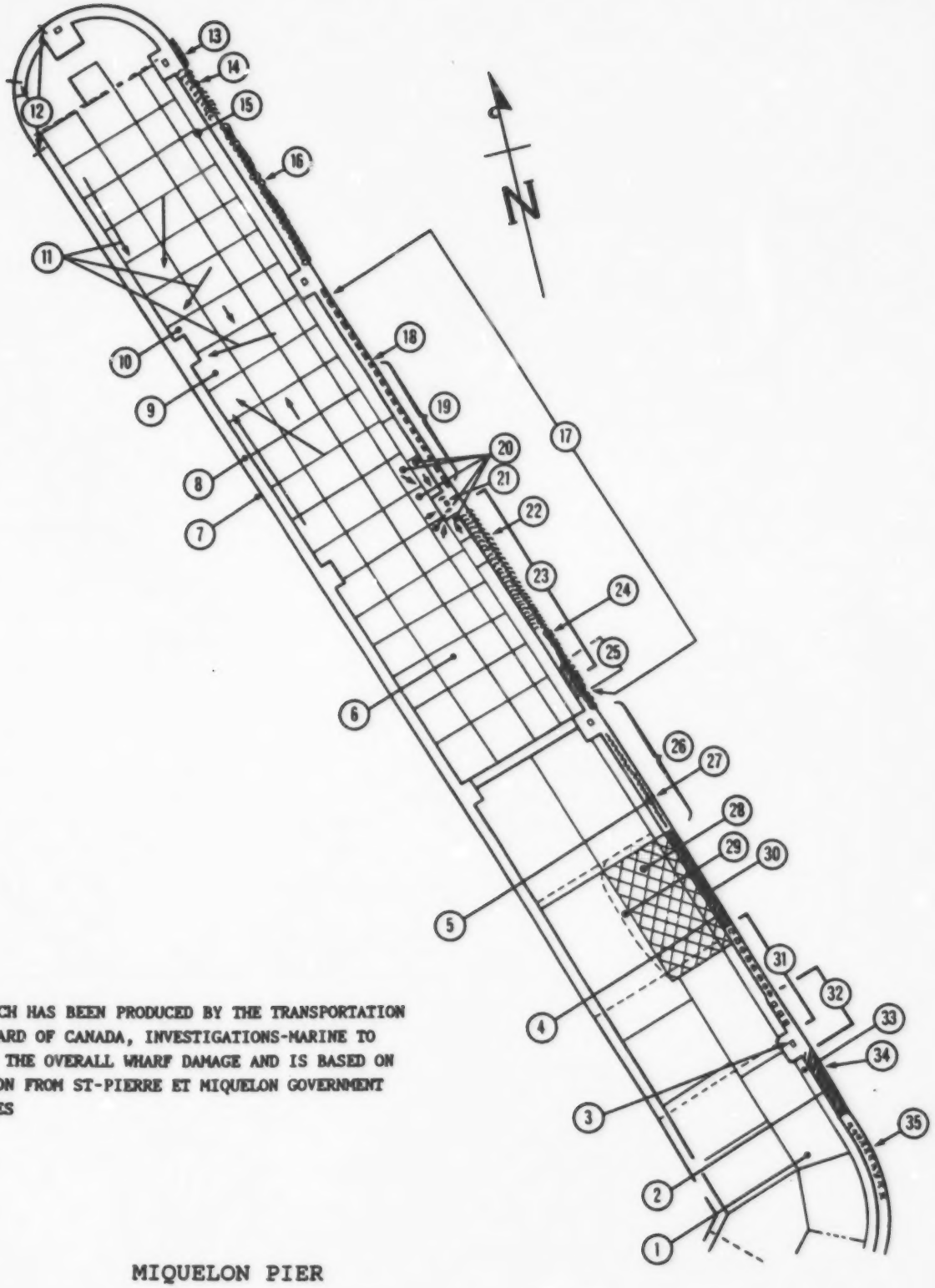


"IMPERIAL ACADIA"

SKETCH SHOWING GENERAL AREA OF DAMAGE

CROQUIS MONTRANT L'EMPLACEMENT DES AVARIES

ANNEX I
APPENDICE I



THIS SKETCH HAS BEEN PRODUCED BY THE TRANSPORTATION SAFETY BOARD OF CANADA, INVESTIGATIONS-MARINE TO HIGHLIGHT THE OVERALL WHARF DAMAGE AND IS BASED ON INFORMATION FROM ST-PIERRE ET MIQUELON GOVERNMENT AUTHORITIES

MIQUELON PIER

REPORT ON DAMAGE CAUSED BY
THE CANADIAN OIL TANKER "IMPERIAL ACADIA"
ON JANUARY 30 AND 31, 1990

1. Lifting of slab up 0.15 m of height.

2. Bulging of the sheet piling over its entire height, horizontally.

3. Tearing away of the bollard from the coping wall + tearing away of the mooring bit from the bollard.

4. Detaching of the sheet from the tie rods, the tilting of the sheet piling, on top, is from 1.00 to 3.00 m, compared with the top of the coping wall, cracking of the sheet piling. Dislocation of the sheet piling, over this height, compared with one another.

5. Tilting of the wall toward the slabbing.

6. Slight sagging of the slabs (2 to 3 cm).

7. Cracks in concrete wall (coping). Some ten in all along the wall, not marked.

8. Lifting of the row of slabs.

9. Maximum sagging of the slabs at this location: 0.20 m.

10. Lifting of the row of slabs.

11. Sagging of the slabs in the direction of the arrows.

12. Cracks in the concrete wall (coping).

13. Shattering of the concrete on the top of the coping wall.

14. Baring of the reinforcing bars and shattering of concrete.

15. Anchor fender torn away.

16. Shattering of concrete, reinforcing bars bared and severed.

17. Tilting of the coping wall toward the slabbing with sagging of the bollard in the middle.

18. Reinforcing bars torn away, concrete removed up to the reinforcement, sea side.

19. Detaching of the coping wall from sheet piling L IV.

20. Sagging of the slabs and inclination toward the bollard.

21. Tilting inward of the bollard with sagging.

22. Shattering of concrete, baring of the reinforcing bars, sea side.

23. Ripping away of the sheet piling L III S horizontally 2.50 m above the coping.

24. Shattering of concrete, baring and ripping away of the reinforcing bars, sea side.

25. Shattering of the coping wall without dislocation.

26. Tearing away of the ridge piece, made up of two 100 mm IPN and located about 3.50 m above the coping wall.

27. 2.00 m long bulging of the sheet piling over the entire height.

28. Sagging of the slab because of undermining + inclination.

29. Undermining of the slabs.

30. Part of the coping wall totally broken. Baring of sheet piling L III S. Tearing away of the ridge piece.

31. Tilting of the wall toward the slabbing.

32. Baring of reinforcing bars, shattering of concrete.

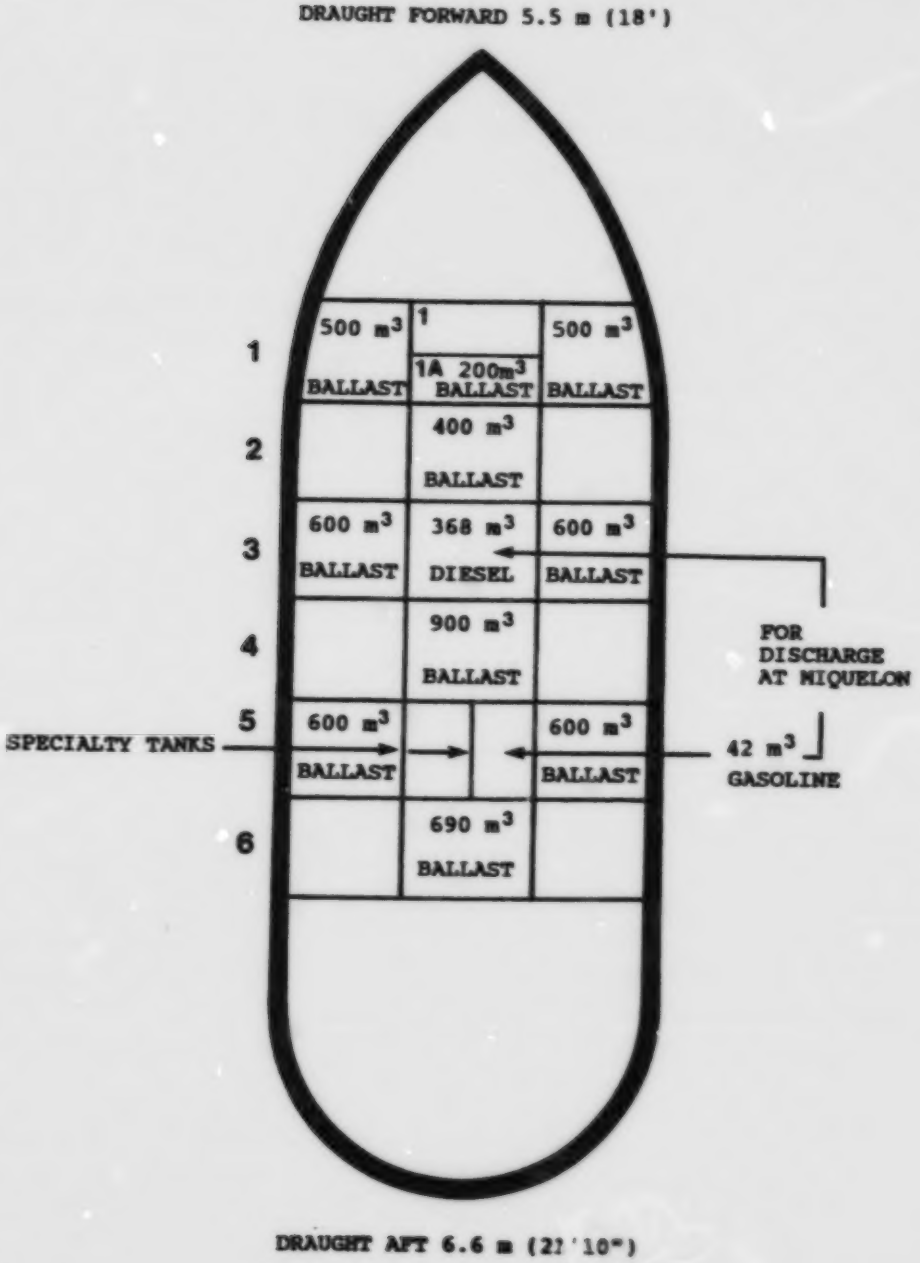
33. Inclination + sagging of wall over 0.70m of its length.

34. Part of the torn away wall, tilting toward the slabbing, baring of sheet piles L III S.

35. Dislocation of the coping wall - concrete + bared bars.

ANNEX III

"IMPERIAL ACADIA"
WATER BALLAST/CARGO
DISPOSITION ARRIVAL MIQUELON
JANUARY 30, 1990



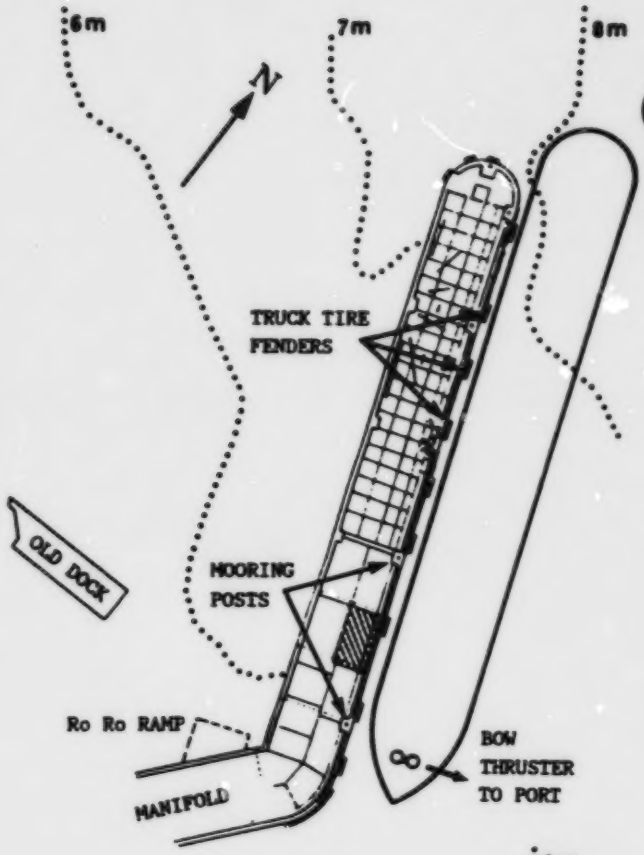
ALL STARBOARD SIDE TANKS HAD CONTAINED GASOLINE AND WERE DISCHARGED AT LEWISPORT JANUARY 27, 1990 WERE NOT WASHED OR GAS FREED.

ANNEX IV

Comparison between barometer/barograph, January 30, 1990

	Barometer (As recorded in deck log book)	Barograph (As per photocopy of graph sheet)	
	millibars	millibars	
0100	1026	1031	
0400	1025	1031	
0800	Not recorded	1031	5 millibars drop trend established
1200	1025	1026	
1400	Not recorded	1023	
1600	Not recorded	1019	
1800	1010	1012	
2000	Not recorded	1007	
2200	Not recorded	1003	
2400	1000	1001	

ANNEX V

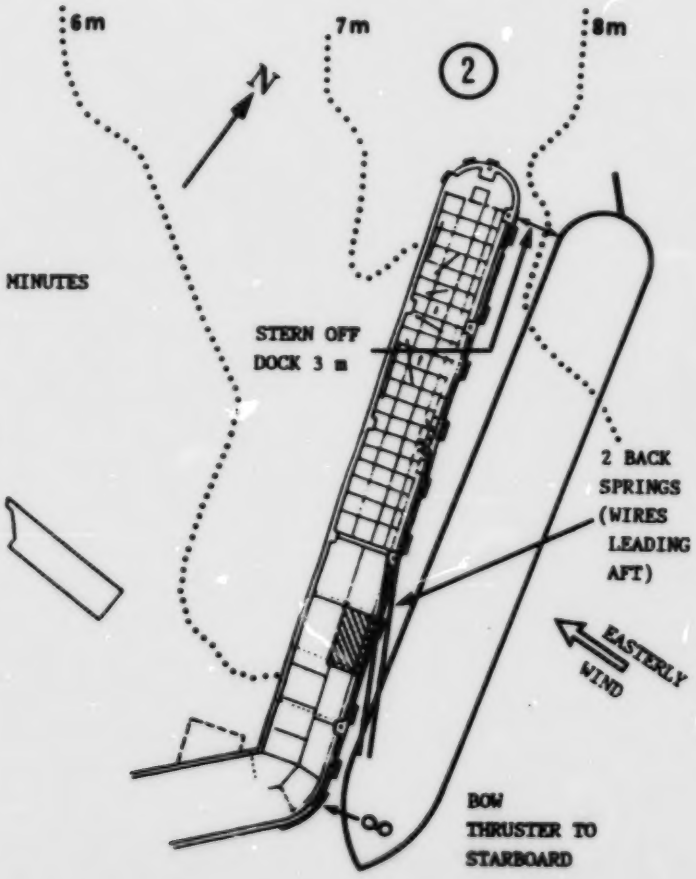


ACTUAL MANOEUVRES

-TIME SPENT ABOUT 2 MINUTES

-DISCONTINUED WHEN BOW THRUSTER UNABLE TO PUSH OFF DOCK

SKETCHES DEPICTING VESSEL MANOEUVRES NOT TO SCALE



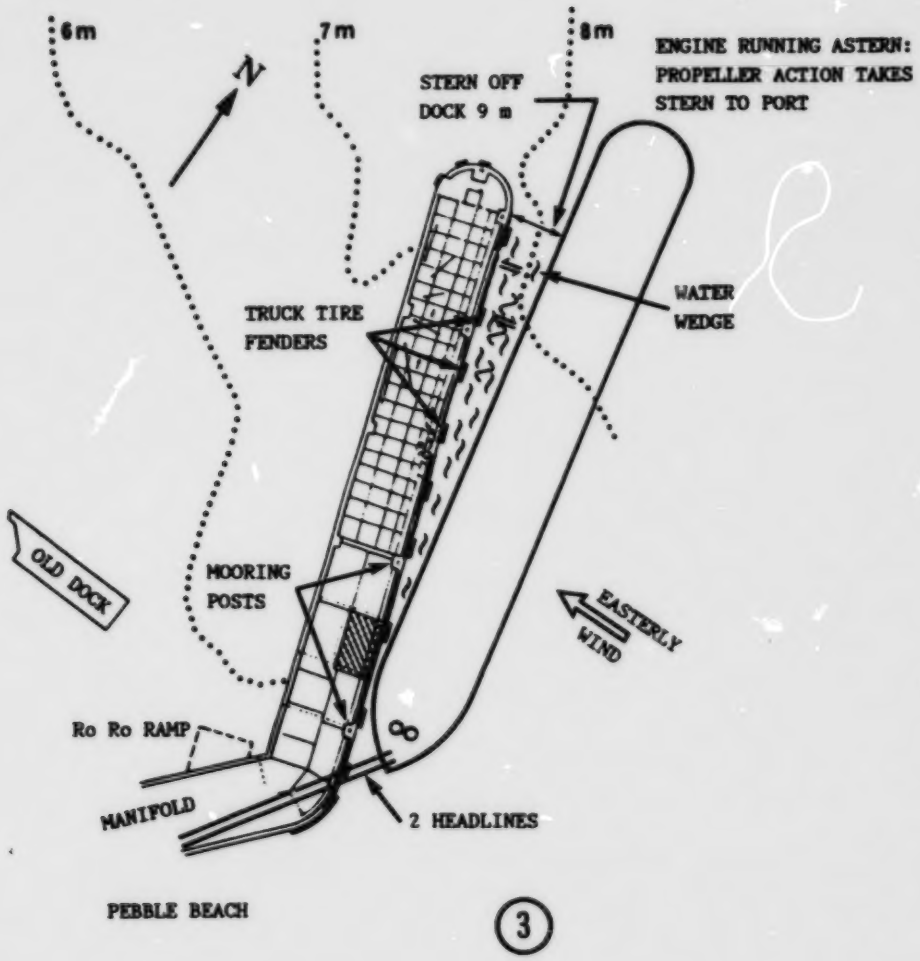
ACTUAL MANOEUVRES

-TIME SPENT ABOUT 6 MINUTES

-MAIN ENGINE HALF AHEAD FOR ABOUT 1.5 MINUTES

-DISCONTINUED WHEN ONE LINE PARTED

SKETCHES DEPICTING VESSEL
MANOEUVRES NOT TO SCALE



3

ACTUAL MANOEUVRES

-TIME SPENT ABOUT 2 MINUTES

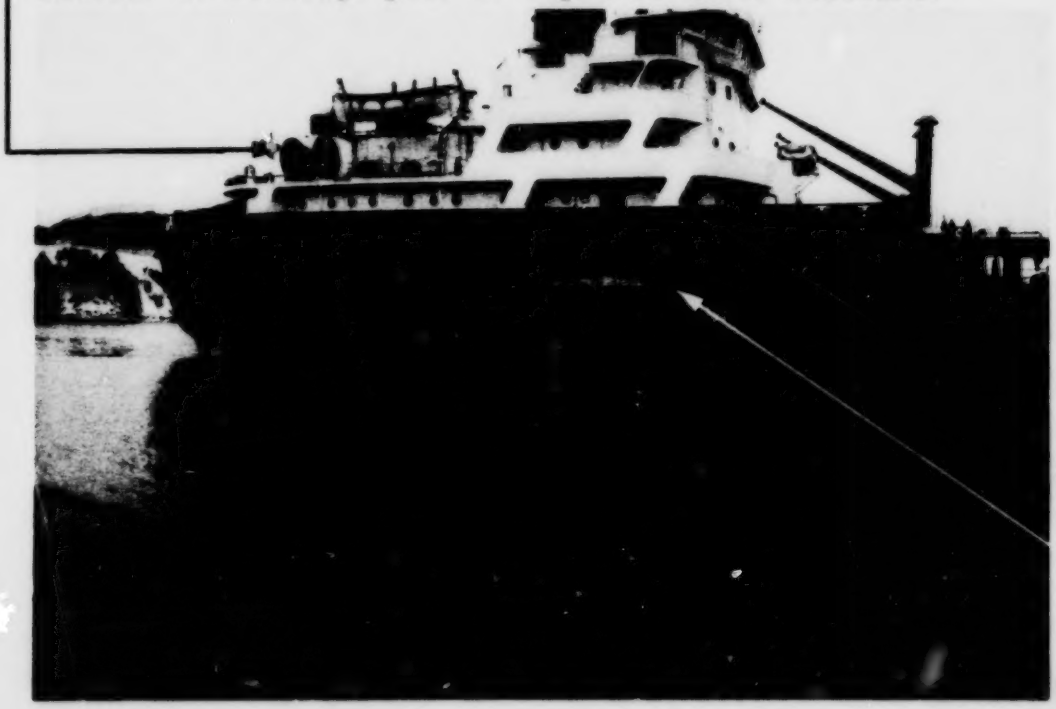
-EFFECT OF WATER WEDGE
BETWEEN DOCK AND VESSEL
DIMINISHES WITH DISTANCE
OFF THE DOCK.
TRANSVERSE THRUST OF PROPELLER
NOT STRONG ENOUGHT TO OVERCOME
THE FORCE OF THE WIND

"IMPERIAL ACADIA" at Marystown, Newfoundland.

"IMPERIAL ACADIA" à Marystown, Terre-Neuve.

'Floater' cargo hose storage reel

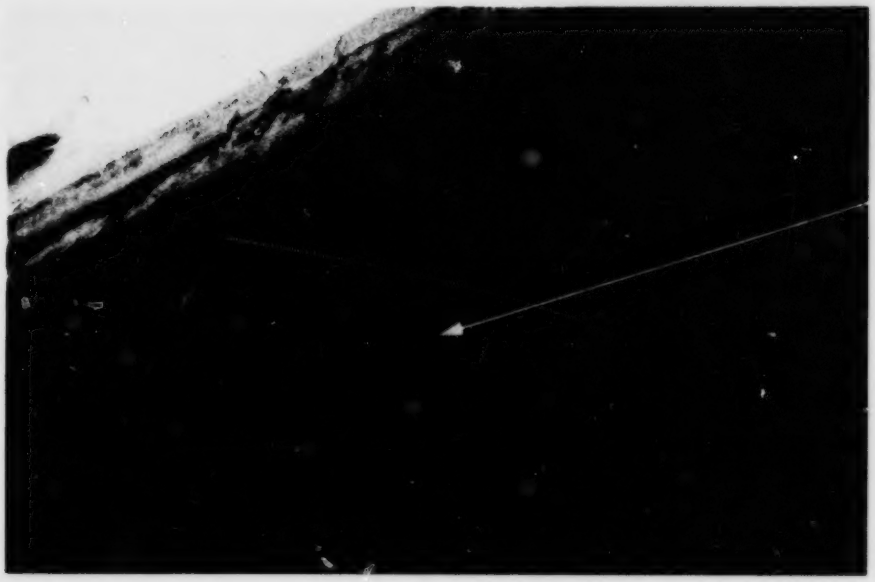
Tambour de remisage pour le tuyau flexible flottant.



Damaged area starboard side engine-room shell plating fractured

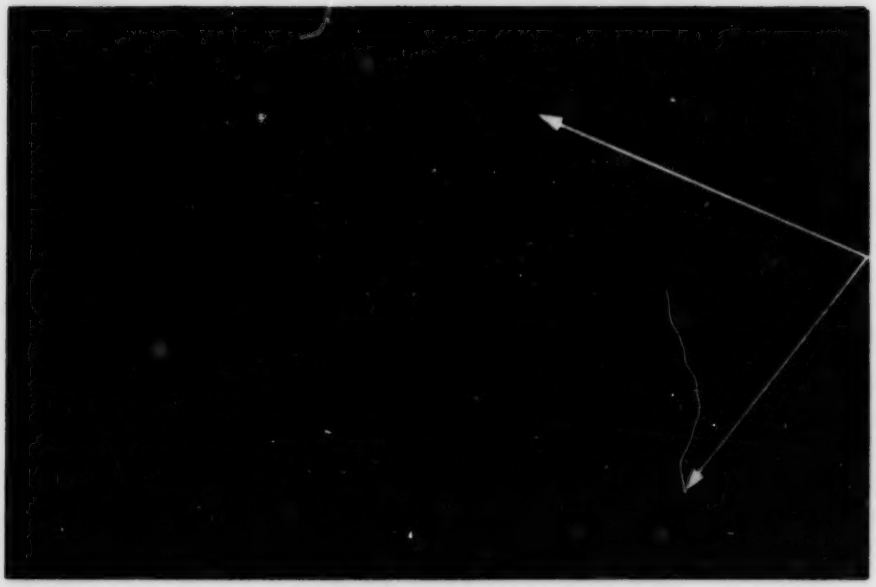
Côté tribord endommagé. Bordé extérieur de la salle des machines déchiré.

"IMPERIAL ACADIA"



Note: extensive fracture in shell plating

Nota: Étendue de la déchirure dans le bordé extérieur.



Starboard side shell plating stitched as a temporary measure

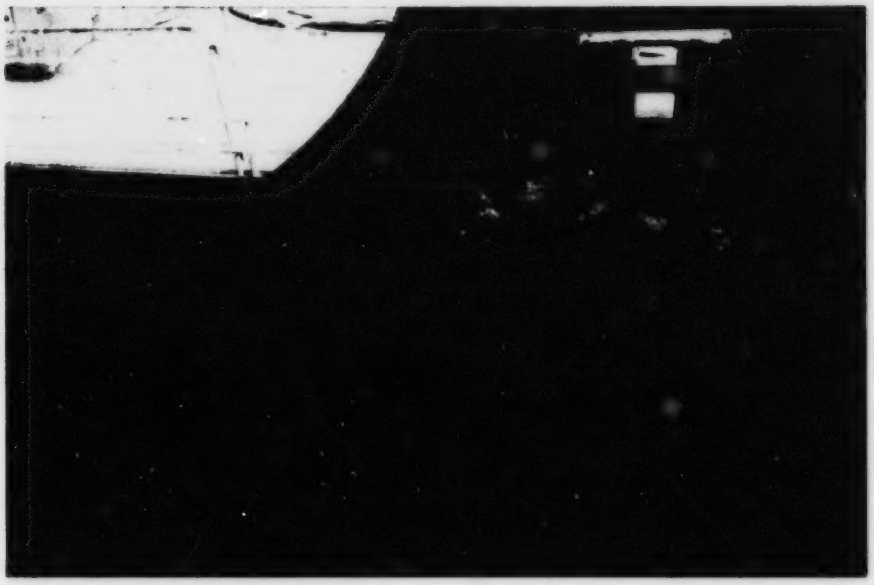
Bordé extérieur côté tribord temporairement agraffé.

Damaged starboard side shell plating.

Bordé extérieur côte tribord endommagé.

"IMPERIAL ACADIA" in Halifax Dry Dock
March 22, 1990

"IMPERIAL ACADIA" en cale sèche à Halifax
le 22 mars 1990



Starboard side forward, "permanent" rudder fendering.

Défense caoutchoutée permanente" à l'avant côte tribord.

Note: extensive damage to starboard side shell plating; delineated for renewal.

Nota: tendue des dommages au bordé extérieur, delinée pour les réparations.

Close-up of fractured starboard shell plating in way of engine-room.

Gros plan de la déchirure du bordé extérieur côté tribord, au droit de la salle des machines.

Shell plating fractured in way of No. 5 starboard wing tank.

Déchirure du bordé extérieur au droit de la citerne latérale N° 5 côté tribord.

"IMPERIAL ACADIA"

No. 4 starboard wing tank. Note: ship side heavily set in, shell plating fractured, internals fractured, heavily set in and distorted. Tank open to the sea and flooded.

Citerne No. 4 tribord. Nota: paroi du navire très renfoncé, bordé extérieur déchiré, déchirures, renfoncement et déformation interne. Citerne éventré et inonde.

"IMPERIAL ACADIA"

No. 5 starboard wing tank. Ship side heavily set in, shell plating fractured, internals fractured, heavily distorted. Tank open to the sea and flooded.

Citerne latérale N° 5 côté tribord. Paroi du navire très renforcé, bordé extérieur déchiré, déchirures et deformations internes. Citerne éventrée et inondés.

"IMPERIAL ACADIA"

No. 6 starboard wing tank. Note: ship side heavily set in. Internals heavily distorted, disturbed.

Citerne latérale N° 6 tribord. Nota: paroi du navire très renfoncé. Intérieur très déformé et déplacé.